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which, by virtue of the relation $A+B+C=\pi$, reduces to

$$\frac{R^2}{2} \{\sin 2A + \sin 2B - \sin 2(A+B)\}.$$

$$\therefore \text{Average area} = \frac{R^2}{2} \frac{\int_0^\pi \int_0^{\pi-A} \{\sin 2A + \sin 2B - \sin 2(A+B)\} dA dB}{\int_0^\pi \int_0^{\pi-A} dA dB} = \frac{3R^2}{2\pi}.$$

31. Proposed by B. F. FINKEL, A. M., Professor of Mathematics and Physics in Drury College, Springfield, Missouri.

Find the average length of a line drawn across the opposite sides of a rectangle, length l and breadth b .

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Applied Science, Texarkana College, Texarkana, Arkansas-Texas; and the PROPOSER.

Let $ABCD$ be the rectangle, FG the random line. Let $AB=l$, $BC=b$, $AH=x$, $AG=y$.

Then $FG = \{b^2 + (x-y)^2\}^{\frac{1}{2}}$.

The limits of x are 0 and l ; of y , 0 and x .

Hence the required average area is

$$A = \frac{\int_0^l \int_0^x \{b^2 + (x-y)^2\}^{\frac{1}{2}} dx dy}{\int_0^l \int_0^x dx dy}$$

$$= \frac{2}{l^2} \int_0^l \int_0^x \{b^2 + (x-y)^2\}^{\frac{1}{2}} dx dy$$

$$= \frac{1}{l^2} \int_0^l \{x(b^2 + x^2)^{\frac{1}{2}} + b^2 \log[x + (b^2 + x^2)^{\frac{1}{2}}] - b^2 \log b\} dx$$

$$= \frac{1}{3l^2} (l^2 + b^2)^{\frac{3}{2}} + \frac{b^2}{l} \log\{l + (l^2 + b^2)^{\frac{1}{2}}\} - \frac{b^2}{l} \log b - \frac{1}{l^2} (l^2 + b^2)^{\frac{1}{2}} - \frac{b^3}{3l^2} + \frac{b}{l^2}.$$

For the line KL , we get, by writing l for b and b for l ,

$$A_1 = \frac{1}{3b^2} (l^2 + b^2)^{\frac{3}{2}} + \frac{l^2}{b} \log\{b + (l^2 + b^2)^{\frac{1}{2}}\} - \frac{l^2}{b} \log l - \frac{1}{b^2} (l^2 + b^2)^{\frac{1}{2}} - \frac{l^3}{3b^2} + \frac{l}{b^2}.$$

$$\text{Cor. I. If } l=b, A = \frac{1}{3}(2l\sqrt{2}) + l \log(1+\sqrt{2}) - \frac{1}{l}\sqrt{2} - \frac{1}{3}l + \frac{1}{l}.$$

Cor. II. If $l=b=1$, $A = \frac{1}{3}(2-\sqrt{2}) + \log(1+\sqrt{2})$, which is the same result as given in *Williamson's Integral Calculus*, page 409.

Also solved by F. P. MATZ.

